Series 3730

Electropneumatic Positioner Type 3730-4 with PROFIBUS-PA communication

Application

Positioner for attachment to pneumatic control valves

Travels 3.6 to 200 mm · Opening angle 24 to 100°

Smart, bus-powered field unit conforming to PROFIBUS-PA specification based on IEC 61158-2 transmission technology.

The microprocessor-controlled positioner compares the reference variable cyclically transmitted over the PROFIBUS-PA network to the travel or opening angle of the control valve and produces the corresponding output signal pressure.

The Type 3730-4 Positioner communicates using PROFIBUS-PA specification according to IEC 61158 and IEC 61784 to exchange data with programmable logic controllers, automation systems and various engineering tools.

Special features

- PROFIBUS-PA Profile 3.01 certified positioner fulfilling all compulsory requirements of PROFIBUS-PA Profile 3.02
- Automatic ID adaptation according to PROFIBUS-PA Profile 3.02 to faciliate replacement of positioners with Profile 2.0 or 3.0 (e.g. Type 3785)
- Classified status alarms acc. to NAMUR Recommendation NE 107
- DTM file available to integrate the positioner into FDT/DTM in compliance with specification 1.2
- Simple attachment to common linear with SAMSON direct attachment interface (Fig. 1), over NAMUR rib (Fig. 2) or to control valves with rod-type yokes acc. to IEC 60534-6-1 or to rotary actuators according to VDI/VDE 3845 (Fig. 3)
- Any desired mounting position
- One-knob, menu-driven operation
- Automatic start-up
- LCD easy to read in any mounting position due to selectable reading direction
- Integrated EXPERTplus diagnostics (T 8389 EN) with additional partial stroke testing for valves in safety-instrumented systems
- Control parameters can be changed online
- Automatic monitoring of zero point
- Calibrated travel sensor without gears susceptible to wear
- Permanent storage of all parameters in non-volatile EEPROM (protection against power failure)
- Temperature and supply air effects negligible
- Adjustable output pressure limitation
- Activatable tight-closing function
- Binary input for DC voltage signals
- Certified according to IEC 61508/SIL

Fig. 1 · Type 3730-4, direct attachment to Type 3277 Pneumatic Actuator

Fig. 2 · Type 3730-4, attachment to NAMUR rib

Fig. 3 · Type 3730-4, attachment according to VDI/VDE 3845

Fig. 4 · Type 3730-4, external position sensor with Type 3510 Micro-flow Valve

Additional options

- Inductive limit switch with proximity switch
- Integrated solenoid valve
- Binary input for floating contact
- External position sensor (Fig. 4)
- Stainless steel housing

Principle of operation

The electropneumatic positioner is attached to pneumatic control valves. It is used to assign the valve stem position (controlled variable x) to the control signal (reference variable w). The input signal received from a control system is compared to the travel or angle of rotation of the control valve and an output signal pressure (output variable y) is produced.

The positioner consists of an electric travel sensor system (2), an analog i/p converter with a downstream air capacity booster and the electronics unit with microcontroller (5).

When a deviation occurs, the actuator is pressurized or vented. If required, the changes in the signal pressure can be slowed down by a volume restriction. The signal pressure to the actuator can be limited by software to 1.4, 2.4 or 3.7 bar.

A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the case as well as to optimize the air capacity booster. The i/p module (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply air pressure.

The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to PROFIBUS-PA specifications.

As a standard feature, the positioner comes with a binary input for DC voltage signals to signalize process information over the PROFIBUS-PA fieldbus.

Operation

The positioner is operated using a user-friendly rotary pushbutton. The parameters are selected by turning the rotary pushbutton, pushing it activates the required setting. In the menu, all parameters are listed in one level, meaning there is no need to search in submenus. All parameters can be checked and changed on site.

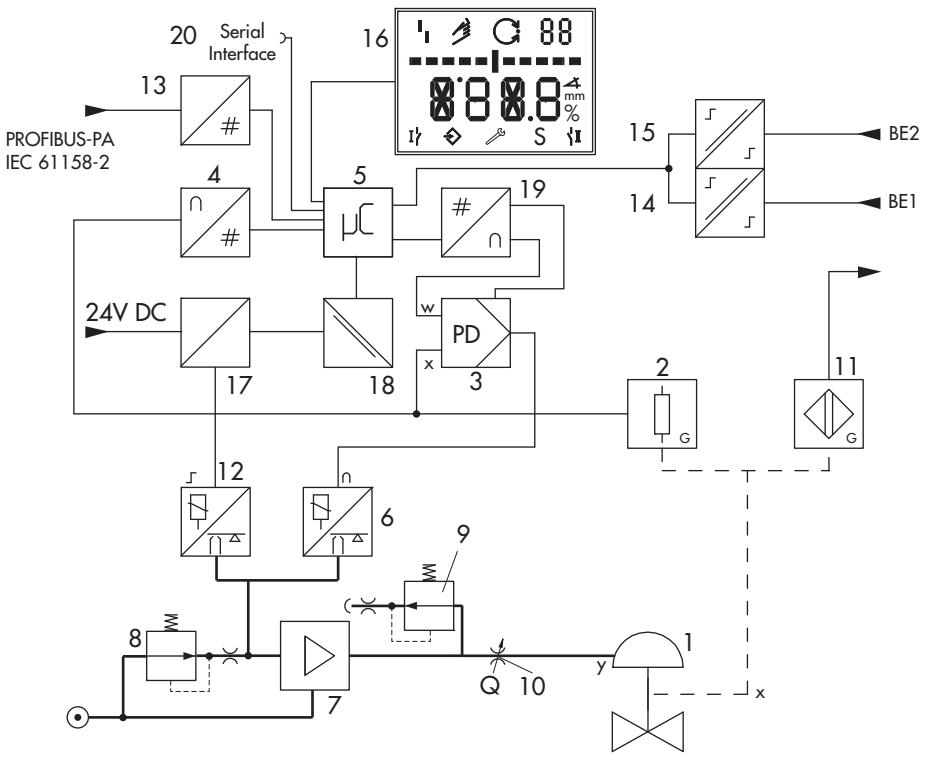
All values are displayed on the LCD. The reading direction of the LCD can be rotated by 180° at the push of a button.

The closing direction of the control valve is indicated to the positioner by the DIP switch "Air to open/Air to close". It assigns the CLOSED position of the control valve to the 0 % reading.

The INIT key activates initialization which is started according to the (pre)set parameters (autotune). After initialization is completed, the positioner immediately starts control operation.

Configuration with TROVIS-VIEW software

The SAMSON configuration software, TROVIS-VIEW, can be used to configure the positioner. For this purpose, the positioner is equipped with an additional digital interface to be connected to the RS-232 interface of a PC. The positioner is adapted to the process requirements over TROVIS-VIEW. The process can be checked while the process is running. The control valve is connected to the process over the PROFIBUS-PA fieldbus.



1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p module
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13 IEC 61158-2 interface module
14 Binary input 1 (voltage input)
15* Binary input 2 (for floating contact)
16 LCD
17* Solenoid valve control
18 Galvanic isolation
19 D/A converter
20 Serial interface (SSP)
* Option

Fig. 5 · Functional diagram of Type 3730-4 Positioner

Table 1 · Technical data

Type 3730-4 PROFIBUS-PA Positioner (technical data in test certificates additionally apply for explosion-protected devices)		
Travel, adjustable	Direct attachment to Type 3277 Actuator	3.6 to 30 mm
	Attachment acc. to IEC 60 534-6-1:	3.6 to 200 mm
	Attachment to rotary actuators (VDI/VDE 3845)	24 to 100° opening angle
Travel range adjustable	Within the initialized travel/angle of rotation; restricted to 1/5 at the maximum	
Bus connection	Fieldbus interface conforming to Field device according to	IEC 61158-2, bus-powered FISCO (Fieldbus Intrinsically Safe COncept)
Communication		
Fieldbus	Data transmission conforming to PROFIBUS-PA specification acc. to IEC 61158 and IEC 61784	
	DTM file acc. to specification 1.2, suitable for integrating the positioner into frame applications that support the FDT/DTM concept. Other integrations, e.g. PDM also possible	
Local	SAMSON SSP interface and serial interface adapter	
Software requirements	TROVIS-VIEW with database module 3730-4	
Permissible operating voltage	9 to 32 V DC · Powered over bus line The limits in the test certificate additionally apply for explosion-protected devices.	
Maximum operating current	15 mA	
Additional current in case of fault	0 mA	
Supply air Supply pressure Air quality	1.4 to 7 bar (20 to 105 psi) Acc. to ISO 8573-1 (2001): Max. particle size and density: Class 4 · Oil content: Class 3 Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected	
Signal pressure (output)	0 bar up to the capacity of the supply pressure	
Characteristics	Linear/equal percentage/reverse equal percentage · User-defined (over operating software and communication) · Butterfly valve, rotary plug valve and segmented ball valve: Linear/equal percentage Deviation from terminal-based conformity ≤ 1 %	
Hysteresis	≤ 0.3 %	
Sensitivity	≤ 0.1 %	
Direction of action	Reversible	
Air consumption	Independent of supply air approx. 110 l_n/h	
Air output capacity Actuator pressurized	At Δp = 6 bar: 8.5 m_n^3/h · At Δp = 1.4 bar: 3.0 m_n^3/h · $K_{Vmax\ (20\ °C)}$ = 0.09	
Actuator vented	At Δp = 6 bar: 14.0 m_n^3/h · At Δp = 1.4 bar: 4.5 m_n^3/h · $K_{Vmax\ (20\ °C)}$ = 0.15	
Permissible ambient temperature	−45 to +80 °C · −25 to +80 °C with inductive limit switch (SJ2-S1N) Limits in test certificate also apply for explosion-protected devices.	
Influences Temperature	≤ 0.15 %/10 K	
Supply air	None	
Vibrations	≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770	
Electromagnetic compatibility	Complying with the requirements of EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21	
Electrical connections	One M20x1.5 cable gland for 6 to 12 mm clamping range · Second M20x1.5 threaded connection additionally exists · Screw terminals for 0.2 to 2.5 mm² wire cross-sections	
Degree of protection	IP 66 / NEMA 4X	
Implementation in safety-related systems in compliance with IEC 61508/SIL	Probability of failure on demand of safety functions PFD < 2.8 x 10^{-7} for a confidence level of 95 %. The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99. Suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.	
Binary input 1		
Input	0 to 30 V DC · Reverse polarity protection · Static destruction limit 40 V/5.8 mA Current consumption 3.5 mA at 24 V, electrically isolated	
Signal	Signal "1" at Ue > 5 V	Signal "0" at Ue < 3 V
Materials		
Housing	Die-cast aluminum EN AC-AlSi12 (Fe) (EN AC-44300) acc. to DIN EN 1706 Chromated and powder paint coated · Special version in stainless steel 1.4581	
External parts	Stainless steel 1.4571 and 1.4301	
Cable gland	Nickel-plated brass, M20 x 1.5	
Weight	Approx. 1.0 kg	

Options for Type 3730-4	
Binary input 2 for floating contact	
Switching input	R < 100 Ω · Contact load 100 mA · Static destruction limit 20 V/5.8 mA · Galvanically isolated
Solenoid valve · Approval acc. to IEC 61508/SIL	
Input	24 V DC · Reverse polarity protection · Static destruction limit 40 V Current consumption $I = \frac{U - 5.7\ V}{3840\ \Omega}$ (corresponds to 4.8 mA at 24 V/114 mW)
Signal	Signal "0" no pick-up ≤ 15 V Signal "1" safe pick-up > 19 V
Service life	> 5 x 10^6 switching cycles
Implementation in safety-related systems in compliance with IEC 61508/SIL	Same as positioner pneumatics
Inductive limit switch	For connection to switching amplifier acc. to EN 60947-5-6.
SJ2-SN proximity switch	NAMUR NC contact
SJ2-S1N proximity switch	NAMUR NO contact
External position sensor	
Travel	Same as positioner
Cable	10 m · Flexible and durable · With M12x1 connector · Flame-retardant acc. to VDE 0472 Resistant to oils, lubricants and coolants as well as other aggressive media
Permissible ambient temperature	–60 to +105 °C · The limits in the test certificate additionally apply for explosion-protected devices.
Immunity to vibration	Up to 10 g in the range of 10 to 2000 Hz
Degree of protection	IP 67

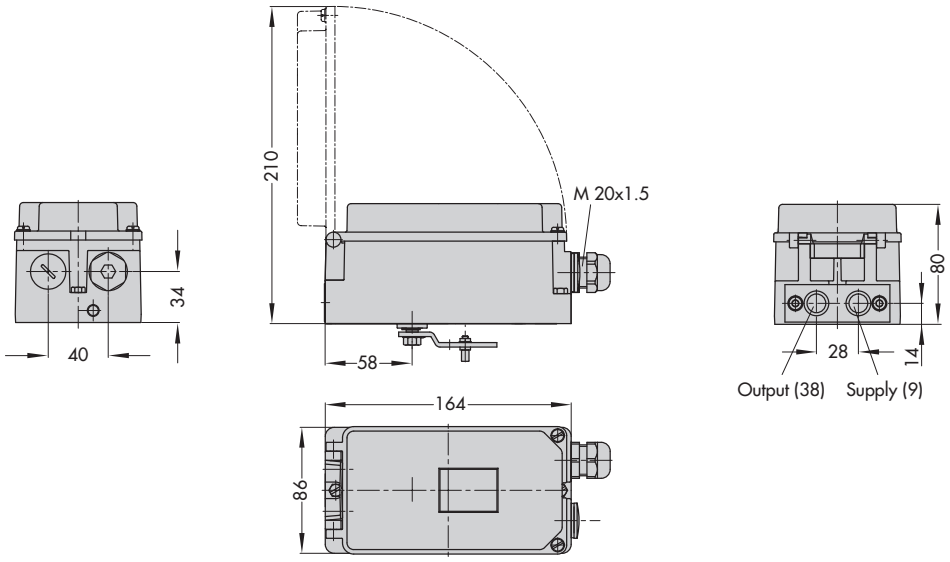
Summary of explosion protection certificates

Type of approval	Certificate number	Date	Comments
EC Type Examination Certificate	PTB 04 ATEX 2109	2004-10-25	II 2G Ex ia IIC T6* II 2D Ex tb IIIC T 80 °C IP 66*; Type 3730-41
First Addendum		2006-07-13	Electrical data for bus connection added
Second Addendum		2007-08-24	Electrical data for forced venting function changed
Statement of Conformity	PTB 05 ATEX 2010 X	2005-02-16	II 3G Ex nA II T6* II 3G Ex ic IIC T6* II 3D Ex tc IIIC T 80 °C IP 66; Type 3730-48
First Addendum		2006-07-13	Electrical data for bus connection added
IECEx	IECEx PTB 60.0054	2006-11-02	Ex ia IIC T6; Type 3730-41
FM approval	3023605	2005-10-31	Intrinsically safe: Class I, II, III; Div. 1, Groups A-G, Type 4x enclosure Class I, Zone 0, AEx ia IIC, Type 4x enclosure Non incendive: Class I, Div. 2, Groups A-D, Type 4x enclosure Class I, Zone 2, Ex nA/nL IIC, Type 4x enclosure Class II, III, Div. 2, Groups F, G, Type 4X enclosure Type 3730-43
CSA approval	1675787	2006-06-01	Ex ia IIC T6; Class I, Div. 1, Groups A-D/Class II, Div. 1, Groups E-G/Class III/Type 4 enclosure Ex nA IIC T6/Ex nL IIC T6; Class I, Div. 2, Groups A-D/Class II, Div. 1, Groups E-G/Class III/Type 4 enclosure Type 3730-43
NEPSI approval	GYJ111267	2011-01-24	Ex ia IIC T6; valid until 2016-01-23; Type 3730-41
	GYJ111268	2011-01-24	Ex nA II T6/Ex nL IIC T6; valid until 2016-01-23; Type 3730-48
GOST approval	B 02637	2012-02-28	1Ex ia IIC T6 X; valid until 2015-02-27; Type 3730-41
INMETRO	2007EC02CP052	2011-09-19	BR-Ex ia IIC T6 IP 65; valid until 2013-09-19; Type 3730-41
CCoE	A/P/HQ/MH/104/1343	2007-04-19	EEx ia IIC T6; Type 3730-41

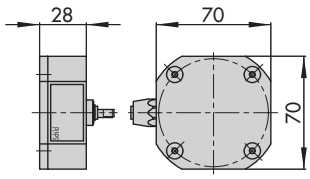
* Marking complying with standard series EN 60079

Dimensions in mm

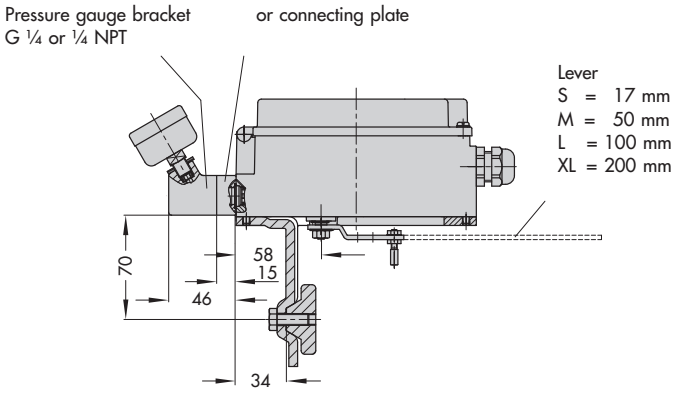
Direct attachment



External position sensor

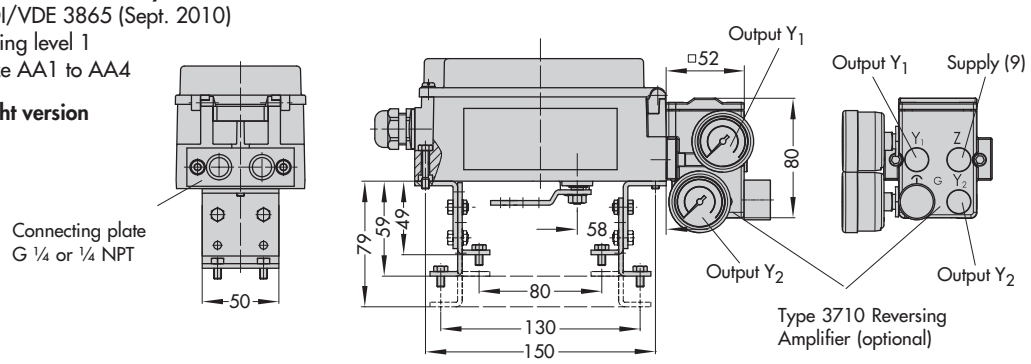


Attachment acc. to NAMUR

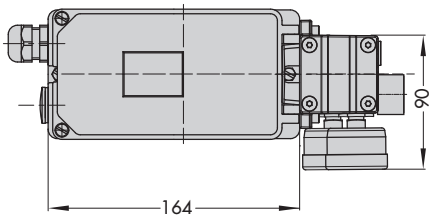


Attachment to rotary actuators
VDI/VDE 3865 (Sept. 2010)
Fixing level 1
Size AA1 to AA4

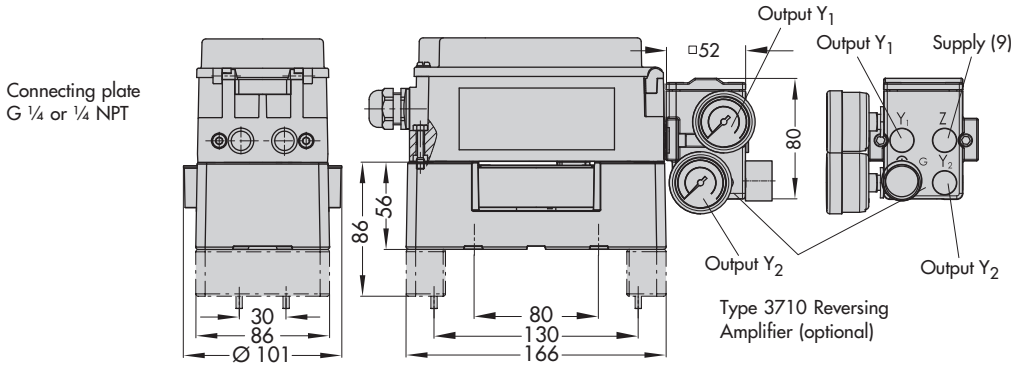
Light version



Mounting unit
CrNiMo steel bracket



Heavy-duty version



Article code

Positioner **Type 3730-4**	x	x	x	0	x	0	x	x	1	x	0	0	x	0	x	x
With LCD and autotune, PROFIBUS-PA																
Explosion protection																
Without	0															
II 2G Ex ia IIC T6, II 2D Ex tb IIIC T 80 °C IP 66 acc. to ATEX	1															
CSA/FM intrinsically safe/non incendive	3															
II 3G Ex nA II T6, II 3G Ex ic IIC T6, II 3D Ex tc IIIC T 80 °C IP 66 (ATEX)	8															
Additional equipment																
Inductive limit switch																
Without		0														
With SJ2-SN proximity switch		1														
With SJ2-S1N proximity switch		2														
Solenoid valve																
Without			0													
With, 24 V DC			4													
External position sensor																
Without					0											
With		0	0		1		0			0						
Binary input																
Without							0									
Floating contact					0		1									
Diagnostics																
EXPERTplus								4								
Housing material																
Aluminum (standard)										0						
Stainless steel 1.4581					0					1						
Special application																
Without													0			
Device free of any substances that might impair paint adhesion													1			
Exhaust air connection with ¼-18 NPT thread, back of housing sealed		0	0		0		0						2			
Special version																
None														0	0	0
NEPSI Ex ia	1													0	0	9
NEPSI Ex nL/nA	8													0	1	0
IECEx	1													0	1	2
GOST approval	1													0	1	4

Power supply and bus connection

The Type 3730-4 PROFIBUS-PA Positioner must be connected to bus segments complying with IEC 61158-2 requirements. A shielded two-wire line is used for both supply power and data communication.

Positioner attachment

The Type 3730-4 PROFIBUS-PA Positioner can be attached directly to the Type 3277 Actuator over a connection block. In actuators with fail-safe action "Actuator stem extends" and Type 3277-5 Actuator (120 cm^2), the signal pressure is routed over an internal bore in the actuator yoke to the actuator. In actuators with fail-safe action "Actuator stem retracts" and in actuators with effective diaphragm areas of 240 cm^2 or larger, the signal pressure is routed to the actuator over a ready-made external piping. Using the appropriate bracket, the positioner can also be attached according to IEC 60534-6-1 (NAMUR recommendation). The positioner can be mounted on any side of the control valve.

A pair of universal brackets is used for the attachment to Type 3278 Rotary Actuators or other rotary actuators according to VDI/VDE 3845. The rotary motion of the actuator is transferred over a coupling wheel to the positioner.

The characteristic is set in the software.

A reversing amplifier is required for double-acting, springless actuators for the second opposing signal pressure.

Ordering text

Type 3730-4 PROFIBUS-PA Positioner

- SAMSON direct attachment
- Attachment according to IEC 60534-6-1 (NAMUR)
- Attachment to rotary actuators
- Without/with pressure gauge up to max. 6 bar
- Explosion protection
- Limit switch
- Solenoid valve
- Binary input for floating contact
- Extended EXPERTplus diagnostics